

a. Mini Injectivity Test

The Permittee may conduct an initial, low-rate, low-injection pressure mini injectivity test ahead of the Step Rate Test (SRT) to assess receptivity of the potential injection interval, and to confirm that the SRT test injection pressures span the range from the measured initial shut-in to the parting pressure of the injection interval. Fluorescein, a fluorescent dye, shall be added to the water to trace the fluid before injecting the tagged water back into the injection well. Fluorescein is a fluorescent, organic dye used in medicine for diagnostic testing and in oceanography as a tracer. The chemical formula for fluorescein is $C_{12}H_{20}O_5$. Fluorescent dyes are the most satisfactory dyes for determining the movement of underground waters, as they are the most easily detected in minute quantities.

The Permittee shall adhere to the following conditions in designing and conducting the mini injectivity test:

- i. Injection as proposed in an approved injectivity test procedure is temporarily authorized while the injectivity test is completed.
- ii. Prior to testing, shut in the well long enough so that the bottom-hole pressure approximates shut-in formation pressure.
- iii. Measure pressures with a down-hole pressure bomb or other approved pressure monitoring system and synchronize the data with data from a surface pressure recorder.
- iv. Use enough rate and volume to establish and extend a fracture which can be monitored with the surface pressure recorder.
- v. After a sufficient volume of fluid has been pumped and a fracture has been propagated, shut down pumps, record the instantaneous shut-in pressure, and monitor surface pressure decline long enough until fracture closure pressure is observed.
- vi. A second injectivity test may be proposed by the Permittee to ensure consistency in fracture pressure results. EPA will evaluate this proposal.
- vii. The Permittee shall report the results to EPA within 45 days of conducting the injectivity test. The results shall include analyses of the pressure decline from the injectivity test and pressure versus rate.

- viii. The Permittee may produce water from the saline injection interval, filter it, and then use it for the injectivity test. The Permittee may also use commercial brine to conduct the injectivity test. Laboratory analysis that yields representative data on the physical, chemical, or other relevant characteristics of all injected fluids proposed for use during the injection test shall be conducted in accordance with requirements outlined in paragraph E.1.(a). If using non-native fluids, laboratory analysis of proposed injectivity test injection fluids shall confirm the non-hazardous nature of the fluids before the injectivity test is conducted.
- ix. Detailed plans for conducting the injectivity test shall be submitted to EPA for review, possible editing, and approval. If approved, Permittee may schedule the injectivity test, providing EPA at least thirty (30) days notice before the test is conducted. Non-native fluids to be used during the injectivity test shall comply with Hazardous Waste Determination (see paragraph D1(b). of this section) and fluid testing requirements (see paragraph E.1(a) of this section).

b. Step-Rate Test

The Permittee shall conduct a Step-Rate Test (SRT) on injection well C6-1 to evaluate formation fracture pressure before CO₂ injection is authorized. Refer to Society of Petroleum Engineering (SPE) paper #16798 for test design and analysis. The SRT results will be used to establish the maximum allowable injection pressure and rate limitations, in accordance with section D, paragraphs 3 and 4 of this part. Detailed plans for conducting the SRT must be submitted to EPA for review, possible editing, and approval. Once approved, the Permittee may schedule the SRT, providing EPA at least thirty (30) days notice before the SRT is conducted. The Permittee shall adhere to the following conditions in designing and conducting their required SRT:

- i. Injection as proposed in an approved SRT procedure is temporarily authorized while the SRT is completed.
- ii. Prior to testing, shut in the well long enough so that the bottom-hole pressure approximates shut-in formation pressure.
- iii. Measure pressures with a down-hole pressure bomb or other approved pressure monitoring system and synchronize the data with data from a surface pressure recorder. Data sampling rate must allow for observation and analysis of the pressure transient behavior during each rate step as well as during the final pressure falloff period which is discussed in item (vi) below.

- iv. Use equal-length time step intervals throughout the test; these should be technically justified and should be sufficiently long to overcome wellbore storage and to achieve radial flow. Use thirty (30) minute or longer time intervals.
- v. Record at least three (3) time steps (data points on pressure vs. flow plot) before reaching the anticipated fracture pressure. Use one (1) barrel per minute rate increments in the early test stages. Larger rate increments may be used later in the test, but justification for this larger rate must be submitted to EPA for approval, in advance.
- vi. At the end of the test, shut down pumps and record the instantaneous shut in pressure and observe the pressure falloff for a sufficient time period to observe and later analyze the radial flow portion of the injection zone during the SRT. The length of time for pressure falloff observation must be determined and discussed in the Permittee's submission plans in advance of conducting the SRT.
- vii. The Permittee shall report the results to EPA within 45 days of conducting the SRT. The results shall include analyses of the pressures versus rate and the transmissivity and storativity for the stepped rates throughout the SRT by analyzing the pressure transient data.
- viii. The Permittee may produce water from the saline injection interval, filter it, and then use it for the step-rate test. The Permittee may also use commercial brine to conduct the SRT. Laboratory analysis that yields representative data on the physical, chemical, or other relevant characteristics of all injected fluids proposed for use during the SRT must be conducted in accordance with requirements outlined in paragraph E.1.(a). If using non-native fluids, laboratory analysis of proposed SRT injection fluids must confirm the non-hazardous nature of the fluids before the SRT may be conducted.